REMARKS

Reconsideration and allowance are requested.

The dependencies of claims 35 and 37 have been corrected. Withdrawal of the claim objections is requested.

Claims 1-6 stand rejected under 35 U.S.C. §103 for obviousness based on Avidor and Choi. The remaining claims 7-37 stand rejected under 35 U.S.C. §103 for obviousness based on Avidor, Choi, and Walton. These rejections are respectfully traversed.

The inventors recognized that there is an inherent time delay between the time instant when a mobile user reports a current channel quality, e.g., in the form of a channel quality indicator (CQI), and the time instant that the base station schedules downlink transmission over a high speed shared channel to a mobile user. During this time delay, the interference may change dramatically. If the difference between the reported channel quality and the actual channel quality at the time of scheduling is large, the selected coding and modulation scheme may not be sufficiently robust to ensure transmission with a low enough error rate. If the data is received in error, the mobile radio requests retransmission which degrades system performance.

This difference between a reported CQI and the actual CQI at the scheduled high speed shared channel transmission is particularly problematic in adaptive antenna systems. An adaptive antenna system can change its beam characteristics in response to changes in the network. Because the base station can detect the direction of a mobile station, it can transmit dedicated information in an antenna beam towards the desired mobile station. By directing the signal just toward its recipient, the interference in the network can be substantially reduced. Adaptive antennas can significantly increase the data capacity in a cellular radio network.

That discrepancy between the reported channel quality and the instantaneous channel quality caused by scheduling different mobile users to receive transmissions over a shared radio channel may be traced in large part to a "flashlight effect." The flashlight effect is described in detail examples in conjunction with Figures 1, 2, 3, and 4. The Examiner is encourage to review these Figures and the accompanying text. In essence, the flashlight effect is intense interference detected by a mobile causing that mobile to report a low CQI for a short time period which results from the mobile being "flashed" by a brief downlink transmission to another scheduled mobile. But after that short flash, the mobile may very well have a very good channel quality leading to erroneous scheduling selections. The flashlight effect is a serious problem in fixed multi-beam systems, adaptive antenna systems, and transmit diversity systems.

The inventors devised technology to overcome the flashlight effect by selecting multiple mobile radios to receive a transmission over a shared radio channel during a predetermined transmission time interval. See for example Figure 6 in this application. The shared radio channel radio resources are allocated to the multiple mobile radios using a resource allocation scheme. An optimal coding and modulation scheme is preferably selected for each scheduled mobile radio to achieve an acceptable error rate. Information is transmitted over the shared radio channel to the multiple mobile radios using multiple antenna beams so that interference from the transmission appears as white additive Gaussian noise in time and in space in the cell. In this way, the flashlight effect caused by a single beam transmission over the shared channel that would detrimentally impact a mobile radio's detection of channel quality is avoided.

But splitting the resources amongst multiple beams during one TTI lowers the peak bit rate because the transmit power per beam largely impacts the achievable bit rate. The highest peak bit rate is achieved by allocating all transmit power resources to one beam in a cell. Yet, as

just described above, a single beam allocation—without careful planning—causes the flashlight effect. But by carefully planning in space and/or in time which beam is used for transmission, the flashlight effect may be avoided. The flashlight effect may be avoided by carefully planning in space and/or in time which beam is used for transmission.

So another technique for avoiding the flashlight effect employs a beam transmission sequence order. Multiple mobile radios may be selected to receive a transmission over a shared radio channel using a beam transmission sequence order. Mobile users belonging to a selected beam may be scheduled. The beam selection is decided using a beam sequence number. Information is transmitted over the shared radio channel to each of the mobile radios in the cell following the beam transmission sequence order. Beam switching in accordance with the beam transmission sequence order occurs over multiple transmission time intervals so that interference from the transmission appears as white noise in time and in space.

Avidor discloses time-division-multiplexed fixed wireless loop system for communicating from a base station to fixed terminals "the present FWL system has a plurality of fixed terminals $15_{1\text{-}n}$. Such fixed terminals have antennas typically installed on roof-tops and the like." Col. 3, lines 62-64. A cell controller associated with each base station allocates communication time slots so as to minimize time slot interference between different base stations. Time slot assignment is based on regional, periodically-updated interference measurements.

The Examiner contends that Avidor teaches "A method for use in a radio communications system with **a** radio base station that includes multiple antennas associated with **a** cell, comprising: selecting **multiple** mobile radios to receive a transmission over a shared radio channel during a predetermined transmission time interval," recited in claim 1. Applicants

disagree. Avidor specifically states that "Each receive beam and each transmit beam communicates with one terminal for an allocated period of time known as a time slot." Col. 1, lines 63-64. See also col. 5, lines 50-59 which teach away from this claim feature:

> a downlink beam 21 transmits information to a single terminal 15_i for the duration of a time slot 35_i...On the other hand, the downlink and uplink between the base station 10d and each of the terminals $15d_7$, $15d_8$, $15d_9$ and $15d_{10}$ are not contemporaneous

So Avidor does not teach a base station selecting <u>multiple</u> mobile radios in a cell to receive a transmission over a shared radio channel during the same transmission time interval.

The Examiner admits that Avidor also fails to teach "transmitting information over the shared radio channel to the multiple mobile radios in the cell during the predetermined transmission time interval using multiple antenna beams so that interference from the transmission appears as white noise in time and in space." The Examiner relies on paragraphs 8-10 in Choi.

Choi discloses a receiver and a receiving method for suppressing interference in the received signal. In contrast, claim 1 is directed to a base station transmitter and a method of transmitting over a shared channel. So it is not understood how Choi is relevant reference. Paragraphs 8-10 are directed to surveying different prior art receivers. Paragraph 8 is the only paragraph that mentions white noise repeated here for convenience: "But the maximum likelihood receiver, which is devised on the assumption that the interference signal and the background noise other than the desired user's transfer signals are AWGN (Additive White Gaussian Noise), has a deterioration of performance in a MAI (Multiple Access Interference) environment." But this assumption is not accurate for adaptive antenna base stations that transmit over a shared transmission channel. Indeed, the flashlight effect of interference that is

present in adaptive antenna base stations that transmit over a shared transmission channel is clearly not AWGN.

So the combination of Avidor and Choi does not teach what is recited in claim 1. Neither Avidor nor Choi describes purposefully transmitting information over shared radio channel to selected multiple mobile radios in one cell during the same transmission time interval using multiple antenna beams from one base station so that interference from those multiple antenna beam transmissions appears as white noise in time and in space. Although multiple users communicate in CDMA over a single spectrum, those users are assigned different radio channels using different spreading codes. There is no teaching in Choi of sharing the same spreading codes between multiple users.

Moreover, the combination proposed by the examiner does not make sense—let alone have the proper motivation to justify that combination. Avidor and claim 1 are focused on transmission, but Choi is focused on reception. In addition, neither reference even mentions the flashlight effect or appreciates the problems it causes. And Choi's technology tries to suppress interference in general at the receiver. There is no attempt to reduce and smooth out specific flashlight type interference prevalent in adaptive antenna transmissions by a base station over in a shared channel at the transmissions side beforehand so that the receiver blasted by the interference produced by the flashlight effect.

The Federal Circuit *requires* consideration of the problem confronted by the inventor in determining whether it would have been obvious to combine references in order to solve that problem. *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 935 (Fed. Cir. 1990). That consideration is lacking in Avidor and Choi. Indeed, the Examiner must show reasons why one of ordinary skill in the art, confronted with the same problem as the inventor and with no

knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. See *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). Absent that recognition, it is clear that the Examiner's attempted combination lacks the requisite motivation. The *Rouffet* Court warned against "rejecting patents solely by finding prior art corollaries for the claimed elements" because that would "permit an Examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art." *In re Rouffet*, 149 F.3d at 1357. That approach was found by the Federal Circuit to be "an illogical and inappropriate process by which to determine patentability." *Sensonics v. Aerosonic Corp.*, 85 F.3d 1566, 1570 (Fed. Cir. 1996).

For claims 7-37, the Examiner admits that Avidor and Choi lack the claimed resource allocation scheme and relies on the teachings of a third reference to Walton. That reliance is misplaced.

Walton describes scheduling terminals for data transmission on the downlink and/or uplink in a MIMO-OFDM system based on the spatial and/or frequency "signatures" of the terminals. But Walton does not try to prevent rapid interference change, but rather tries to ensure that scheduled users in the parallel OFDM transmissions have equal signal-to-noise ratios (SNRs).

None of the three references discloses "spread[ing] out the interference caused by the transmission" of information "to the multiple mobile radios in the cell during the same predetermined transmission time interval using multiple antenna beams," as recited in claim 16, and as explained above, none teaches that the claimed interference "from the transmission appears as white noise in time and in space in the cell," as recited in claim 17.

Claim 34 recites "performing beam switching in accordance with the beam transmission sequence order after multiple transmission time intervals so that the flashlight effect is avoided." Claims 15 and 31 recite: "wherein the transmitting to the multiple mobile radios in the cell during the predetermined transmission time interval using multiple antenna beams prevents a flashlight effect from disrupting the channel quality detection performed by the mobile radios." This feature is not taught in any of the three applied references.

The Examiner refers to col. 49, lines 14-24 of Walton repeated here for convenience:

> In yet another embodiment, the partial CSI comprises signal components in a matrix form (e.g., N_R x N_T complex entries for all transmit-receive antenna pairs) and the noise-and-interference components in matrix form (e.g., N_R x N_T complex entries). The transmitter unit may then properly combine the signal components and the noise-and-interference components for the appropriate transmit-receive antenna pairs to derive the quality of each transmission channel used for data transmission (e.g., the post-processed SNR for each transmitted data stream, as received at the receiver unit).

No where in this text is the flashlight effect problem described or a solution taught. Rather, this text simply describes combining signal, noise, and interference for transmit-receive antenna pairs to determine the SNR for each transmitted data stream as received at the receiver unit.

The Examiner also refers to paragraph 122 in Choi as allegedly teaching "performing beam switching in accordance with the beam transmission sequence order after multiple transmission time intervals so that the flashlight effect is avoided," as recited in claim 34. This text is repeated here for convenience:

> For the simulation, a Rayleigh fading channel with one (refer to (a) of FIG. 9) or three (refer to (b) of FIG. 9) multipaths is used. The simulation involves fifty users having the same transmission power and a 3GPP short scrambling code having a period of 256 chips. The simulation is performed at a fading change rate of 10^{-3} that can be expressed by the multiplication f_D T of Doppler frequency f_D by

> the code period Time T, while switching the number of receiver antennas between one and two.

The text here is describing a simulation of the adaptive interference suppression receiver (see 0121). Applicants do not understand how this teaching is relevant to the claimed transmission technique where adaptive antenna beams are switched in accordance with a beam transmission sequence order after multiple transmission time intervals so that the flashlight effect is avoided. Where is the problem of the flashlight effect, as explained above, described in Choi? Where does Choi describe a solution to the flashlight effect problem?

The obviousness rejections are improper and must be withdrawn. Accordingly, the application is in condition for allowance. An early notice to that effect is respectfully requested.

Respectfully submitted,

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